cancer of the cervix is necessary if there is to be a tangible hope of permanent cure from any of the surgical procedures with which we are familiar.

2. Early diagnosis can be attained through the education of the individual patient by her personal physician, by removal of a section for examination from every cervix in the least suspicious, and by the routine pathological examination of specimens from every case in which repair or amputation has been performed.

3. Many cases of cancer of the cervix might be prevented if high amputation were adopted as a routine procedure in every case of lacerated eroded hypertrophied cervix found in women beyond the probable child-bearing age.

4. As a rule, with but few exceptions, radical pan-hysterectomy should be limited to those cases which are discovered before any marked symptoms or positive physical signs are present.

5. In the general interests of humanity and humaneness, all bloody or painful procedures should be abandoned in late cases, and palliation by radium adopted as the routine procedure.

6. In border line cases the condition and outlook should be presented with the utmost frankness and the patient's desires should then have as much weight as any other factor in determining how the case should be managed.

Title Insurance Bldg., Los Angeles.

NOTICE

The December Journal will contain a symposium on Industrial Medicine.

THE VALUE OF BLOOD STUDIES*

By WM. PALMER LUCAS, M. D., San Francisco.

Modern methods of bio-chemistry and physiology have introduced a new conception of the value of blood studies, not only in the understanding of anæmias, either primary or secondary, but also in the study of many other diseases. A true value of the function of kidneys can be better appreciated through a study of the blood than by a study of the urine. In the same way some of the newer methods of analyzing the blood throw light on diseased conditions in other organs, such as the liver, and lungs, and in the complicated problems connected with digestion.

Hemoglobin may be present in sufficient volume and yet the oxygen be unable to be carried or given off in sufficient amounts to satisfy the needs of the tissue cells throughout the body. An example of the inability of the red blood cells to give off oxygen, even though the hemoglobin is present in normal amounts, is that produced by simple cold. Another example is the presence of abnormal salt concentration of the plasma. Exactly how these two factors of temperature and salt contents of the plasma affect the affinity of hemoglobin for oxygen is not well known. The amount of oxygen that can be taken up, and the rapidity with which oxygen can be given off, varies with the temperature of the body. This is an important factor in the temperature regulation during early infancy. All who have watched newborn infants with disturbed temperature regulations have noted the cyanosis which occurs in these infants with a low body temperature.

The fact that hemoglobin is a colloid and the knowledge we have of the interrelation of electrolytes and colloids makes it evident that the salt content of the blood must affect and regulate to a certain extent the transfer of oxygen. It has been shown that potassium salts are capable of causing hemoglobin to absorb oxygen to some degree. Many studies have demonstrated the fact that the loss of water with the resulting concentration of salts affects the oxidation of the tissues. The buffer quality of these salts undoubtedly affects the oxygen transfer from the hemoglobin to the body cells. This is, as we know, intimately connected with another factor, the hydrogen ion concentration of the blood. It is well known that increasing the acidity of the blood lessens its active concentration of oxygen. The importance of studying the relation of hemoglobin to the three factors, temperature, electrolytes and hydrogen ion concentration, is indicated in the study of almost all blood diseases.

The morphological study of blood furnishes very reliable data as to the condition of the blood-forming organs. Normally the blood level is kept up by daily destruction and replacement of cells. Ashby has recently determined, by estimating the disappearance of cells transfused by the differential agglutination test, that the normal life of the red blood cell is approximately thirty days.

Destruction is continually carried on by the following processes:

FIRST. By phagocytosis. The endothelial cells of the spleen, liver and other organs take part in this process.

SECOND. By fragmentation. This is shown by the occurrence of microcytes and poikilocytes. Fragmentation is produced in the circulation and not in the bone marrow. Normally, there are a few such cells always present within the circulation, but under pathological conditions, when young cells are thrown out in large numbers, these young cells cannot stand the functional strain put on them and become easily fragmented. Under pathological conditions, not only fragmenting cells, but also cells with vacuoles may be found. These ultimately become hemoglobin dust and are removed from the circulation to be stored in the spleen. Such hemoglobin dust is found normally in the spleen, but appears in much greater quantity in anemic conditions.

THIRD. Destruction occurs by hemolysis. Under normal conditions this probably plays very little part, as hemolysis is normally an intra-cellular process, but in pathological conditions it may play a big part. Under such conditions hemoglobinuria occurs often accompanied by fever and chills.

FOURTH. Disintegration is also shown by the increased fragility of the red blood cells. This is especially found in certain pathological conditions, such as congenital hemolytic icterus, in which there is pronounced blood destruction.

* Read before the Fiftieth Annual Meeting of the Medical Society of the State of California, Coronado, May, 1921.

Regeneration. Processes of regeneration are also continually going on. Normally, the bone marrow only produces enough red blood cells to maintain the daily loss of red blood cells in the normal wear and tear of life. Bone marrow activity is only limited by its functional capacity. This may be hyperstimulated under certain conditions, such as by a diminished oxygen supply as is found in high altitudes, or where there is difficulty in the absorption of oxygen through the lungs, as in congenital cardiac conditions. Bone marrow activity normally is a balanced process between blood destruction and regeneration. Certain tests may be carried out to determine how this balance stands at any given time.

FIRST. Urobilin estimations in the urine and stools can be used to estimate the presence or extent of blood destruction.

SECOND. By means of vital staining such cells, as the Howell-Jolly bodies, Cabot's ring bodies and stippling may be made out. These give some idea of the effort which the bone marrow is making in the production of red blood cells and in its effort to maintain the optimum level.

THIRD. Such an estimate of the effort which the blood-forming organs are making may be estimated by the number of (1) reticulated cells; (2) platelets, and (3) mitochondria, all of which can be determined by special staining methods. Normally, reticulation exists in from ½ to 2 per cent of the red blood cells. With marked bone marrow activity this percentage is increased. In simple anemia it usually does not go higher than 4 or 5 per cent. In hemorrhagic jaundice one finds reticulated cells as high as 15 to 20 per cent, and after hemorrhage this may be even higher, 20 to 30 per cent. The percentage of reticulation is, therefore, of great diagnostic value. As they diminish after hemorrhage this can be considered as a good prognostic indication. The estimation of platelets also gives us an idea of the activity of the bone marrow. Platelets are increased where there is marked activity and decreased where there is a defective regeneration. In diseased conditions, where they have been reduced, their return to normal may be a favorable sign.

Mitachondria. These are small limpid bodies found within the cell protoplasm. They are not found in adult or fully formed red blood cells, but are found in nucleated red blood cells and in imature red blood cells. Their presence and estimation gives us some idea of the number of immature cells in circulation.

It has been shown that oxygen consumption may be proportional to the percentage of reticulated cells. Normally human red cells consume very little oxygen. In anemia the consumption of oxygen by the red blood cells may be marked, and this has been found to depend on the presence of reticulated cells. The demonstration of an increased oxygen absorption by accurate methods may prove a more quantitative index of functional variations in bone-marrow activity than the microscopic evidence taken alone.

In any study on the regeneration of hemoglobin and red blood cells, it is important that the determination of hemoglobin percentage be as accurate as possible. Various estimations with the ordinary methods of testing hemoglobin, as by the Tallquist, have shown that they may give an error of from 5 to 20 per cent. The newer methods of estimating hemoglobin are based on the oxygen capacity of the red blood cells. The most accurate method so far published is that of Palmer for determining hemoglobin percentage by the oxygen capacity of the hemoglobin. Robscheit has modified this somewhat, and determines the hemoglobin in the form of acid hematin. Some such method as that of Palmer or Robscheit should be adopted for all clinical purposes for the determination of hemoglobin, as accurate estimates are much to be desired in the study of blood regeneration and destruction.

The study of hemoglobin pigment metabolism is also important. The liver has not only an eliminative function in forming bile pigment from the freed hemoglobin of broken-down red blood cells but, as shown by Whipple, it also has a constructive function. The liver can construct bile pigment probably from its endothelial cell activity, and under certain conditions there may be extra hepatic bile pigment production. The liver has some constructive function in hemoglobin regeneration, and this can be definitely modified by diet. It has been shown that the liver can construct hemoglobin out of other material than broken-down red blood cells. Elements of protein catabolism and certain factors in the diet contribute to the steady construction of hemoglobin. Further, the liver cell activity has not only to do with hemoglobin or blood pigment metabolism, but upon the functional activity and integrity of the liver cells depends also the level of the plasma and serum proteins. Liver function in this respect is influenced not only by tissue catabolism but by diet. A diet rich in meats, liver and certain vegetables will markedly stimulate hemoglobin production, whereas a high carbohydrate diet will diminish it.

As has been stated, the rate of hemoglobin destruction may be estimated by the amount of urobilin in the stools and urine. In the urine it may be increased when there is no marked destruction of hemoglobin or of red blood cells, but may indicate a poorly functioning liver where the urobilin is not removed from the blood and appears in the urine. This may be tested by some of the newer methods of estimating urobilin in the blood serum and gives an estimation of liver function. In the diagnosis of various types of liver disturbance before urobilin either appears in the urine or there is icterus, it must be present for some time in the blood serum in amounts that are often below the level of kidney excretion or icterus. For the reason that urobilin may occur in the urine in conditions other than those associated with excessive blood destruction, stool and urine and blood serum determinations of urobilin must be made. The hepatic origin of urobilin under certain conditions must be borne in mind. In any case the figures for urobilin in

urine and stool should be compared with a normal standard.

Lately another method for estimating blood destruction has been suggested by the injection of sterile hemoglobin solution. The tolerance or lack of tolerance is shown by the appearance of hemoglobinuria in cases of blood destruction. The test may be of quantitative value as the amount of hemoglobin needed to induce hemoglobinuria is directly proportional to the degree of blood destruction, and the tolerance of hemoglobin may be shown to be low in conditions which are usually accompanied by elimination of urobilin.

Coagulation: This may be defined as the colloidal change, which occurs under the influence of calcium electrolytes during which the blood is transformed from the fluid state into the solidified state, which we recognize as coagulated blood. The changes which take place during this process are now more clearly understood, because the various factors which enter into them have been made capable of separate analysis. Coagulation of normal blood may be divided into three stages. Of the first stage very little is known, except that certain definite changes take place within a very short period of time. The second stage, which is the formation of thrombin, depends on the reaction between two substances, cytozyme and serozyme, the one obtained from the cellular elements, and the other from the plasma acting in the presence of calcium salts to form thrombin, which in turn, during the third stage, combines with fibrinogen to form the fibrin clot. It has been clearly demonstrated that the factor, fibrinogen, is disturbed in conditions primarily affecting the liver. Calcium itself is rarely affected except in those cases in which there is a sufficient quantity of bile salts in circulation to combine with the calcium salts, and thus render them unavailable for combination with the serozyme or eytozyme.

The factor concerning which we know the most is that derived from the cells, particularly the platelets. There are two main conditions in which there is marked disturbance of this factor. In purpura hemorrhagica there is a deficiency in the number of platelets. When the platelet count falls below 100,000 we are in danger zone; when it falls below 20,000 hemorrhage from lack of platelets will occur. In hemophilia and in the ordinary case of hemorrhage of the new-born, there is a qualitative change in the platelets or their product prothrombin. The total number of platelets may not be diminished, but qualitatively they are so changed that hemorrhage may occur at any time. In hemorrhage of the new-born this is a temporary condition and usually passes away within a very short time. We have been able to show from experimental work on the blood of the new-born that there is, during the first few days of life, a definite qualitative defect or perhaps better a lack of equilibrium in the prothrombin element. In hemophilia the condition is hereditary and constantly present whether there is bleeding or not. There are certain other types of hemorrhage of the new-born, such as that which occurs during acute septic infection in which the antithrombin, which Howell has demonstrated, is the main factor at fault and certain other cases of liver injury, as demonstrated by Whipple, in which the fibrinogen is at fault, but the usual case of hemorrhage of the new-born, and certainly those which respond to blood transfusion, are those in which the prothrombin element is affected.

The fact that the life of the blood platelets is approximately only four days explains the reason why the value of transfusion in hemophiliac conditions is so short-lived. As soon as the transfused platelets disappear the primary condition returns. Some permanent effect on the prothrombin element has been obtained by feeding kephalin or thrombinlastic substance to hemophiliacs. This line of treatment, we feel, offers the best permanent results in true hemophiliac conditions, whereas direct transfusion in the temporary disturbance of prothrombin in the new-born successfully cures this condition, as the prothrombin factor reaches its normal level probably toward the end of the first week. This explains very clearly the success which transfusions have given in these cases of hemorrhages of the new-born. It is important to determine the coagulation time by proper methods. The ordinary method of determining coagulation time by obtaining the blood from puncture wounds is open to grave objections. Unless the blood is derived directly from a vein, tissue juices are mixed with the blood, which so affects the coagulation time that a true picture is not obtained. Normal coagulation time of blood taken from a vein averages from 6 to 12 minutes, anything over 20 minutes means definitely delayed coagulation. In estimating hemorrhagic conditions, coagulation time, bleeding time and platelet counts, with a study of retractility of the clot, fibrinolysis and recalcifying time of oxalated blood gives us sufficient data on which to make an accurte diagnosis of what factor is presumably at fault in any given case.

At the present time there is a great deal of work being done by studying the blood by chemical methods. The impetus to this work rests on the introduction, by Folin, of the micro-chemical methods of studying small samples of blood, and almost every week new methods of study are being brought out. I shall not attempt to describe any of the various methods, but some of the results of these studies and their application to a better understanding of disease should be considered if we are to understand the blood as a tissue which is capable of bearing intensive investigation and which lead materially to a better comprehension of normal and diseased conditions.

It is of interest to note that in certain nutritional conditions the blood proteins vary materially. Normally, the blood proteins vary from 7 to 8 per cent in the adult. This level during the first year is from 6 to 6.5 per cent. In cases of malnutrition it may be reduced to 4 or 5 per cent or even lower. The same may be true of the blood proteins of premature infants. And in diarrheal conditions during infancy the blood proteins may rise to 8 or 9 per cent. Whipple, in

his studies on blood serum protein regeneration, has found that where the serum protein is depleted to 1 per cent, this appears to be the absolute minimum below which the body cells cannot survive. When 2 per cent is reached, this is found to be a dangerous level of depletion. These experimental findings of Whipple agree very closely with those of Utheim in athreptic or malnutrition infants. It is important, therefore, in these cases of malnutrition to estimate the amount of blood protein present. It has been pointed out that there is a marked similarity between the parenchymatous regeneration and the blood serum protein regeneration. Whipple suggests that it may very well be that the protein for the parenchyma cells or the protein for the blood plasma may require similar construction periods and building material, and it may be that the blood protein construction depends on the activity of the cell protein. This regeneration period in chloroform poisoning, where the liver is injured, takes from seven to ten days. These studies are very suggestive and throw light both on the prognosis of nutritional conditions and also on the progress of the condition if the proteins can be followed for their regeneration or lack of regeneration. In some of the nutritional conditions, in which the blood proteins are reduced to the danger limit, repeated transfusions of comparatively small amounts of blood will often assist in tiding over very critical nutritional periods by raising artificially the blood protein level, and will thus give an opportunity for the body cell metabolism to functionate from a better metabolic basis.

The importance of studying blood sugar has been clearly demonstrated in the study of diabetes. It is a well-recognized fact that the excretion of sugar by the kidneys is a sort of safety-valve factor. The real condition which needs careful attention is the hyperglycemia. The importance of this is shown in that as diabetes advances, glycosuria becomes less and less a safe criterion of the condition of the disease, since the permeability of the kidneys for sugar is greatly lowered, especially as nephritic symptoms appear, and blood sugar is a far better criterion of how the condition is progressing.

Of further importance in the study of diabetes, from a prognostic as well as from a therapeutic standpoint, is the hydrogen ion concentration of the blood. This is especially true as an index of present or approaching acidosis, for the blood sugar and alkali reserve in the body are important as determining factors and as indicating how the disease is progressing.

Since the introduction of simple methods for estimating the carbon dioxide combining power of the blood, much light has been thrown on the phenomena of acid intoxication. Acidosis may result either from the overproduction of acid bodies or by their decreased elimination. The normally slight alkaline reaction of the blood is maintained by the influence of the bicarbonate, chlorides, phosphates and proteins of the blood. The carbonates may be considered as a first line of defense. During acidosis other acids combine with the carbonates and lower the body's alkaline reserve. Under normal conditions the kidneys are able to secrete an acid urine from a nearly neutral blood through the medium of acid phosphates, which may be considered as the second line of defense, and it is this line of defense, the acid phosphates, which breaks down in the acidosis of nephritis with an increase of the non-volatile acids and a diminished available supply of alkali. Testing the amount of acetone and diacetic acid in the urine does not give very much indication as to the severity of an acidosis. The estimation of the carbon dioxide combining power of the blood gives this information much more accurately. This is especially true in following the treatment of diabetes by the Allen method. In severe nephritis, the retention of nitrogen and acetone often accompany each other, and this type of acidosis is more easily corrected by alkaline treatment than the acidosis of diabetes, in which fasting will often check the acetone body formation and so affect the acidosis much more readily than by giving alkali.

It has been shown that the respiratory center is controlled by the reaction of the tissue fluids in the respiratory center. This is dependent on the CO_2 tension, and this tension in the tissues must exceed that of the arterial blood and must be higher than in the venous blood. In anemia the carbon dioxide carried from the tissues, for each change in tissue tension is less than normal, as has been pointed out by Peters, and unless the blood flow is increased this will result in an accumulation of the carbon dioxide within the tissues. With each increase in the carbon dioxide tension the hydrogen ion concentration rises relatively rapidly. In severe anemia there is a tendency to accumulation of carbon dioxide in the tissues, a diminished ability of the blood to lose carbon dioxide in the lungs and relatively rapid change in the hydrogen ion concentration with any change in the CO_2 tension. All these factors tend to excite the respiratory center and produce dyspnœa. This is, in particular, caused by the low hemoglobin and, therefore, changes in the CO_2 tension produce great changes in the hydrogen ion concentration.

In any case in which the acid base equilibrium of the blood is disturbed the resulting acidosis may be compensated or decompensated, as has been pointed out by Means and his co-workers, and it is important to determine which of these two states exist. This is valuable not only from a prognostic standpoint, but also from the standpoint of treatment, for in a compensated acidosis, though the alkali of the blood may be diminished on account of an increase in the non-volatile acids, the blood may have a normal reaction and the acidosis be compensated. In such a case alkali therapy may not be indicated, and at times it may do more harm than good. In decompensated acidosis, alkali is necessary to change the reaction of the blood. In such cases, however, the equilibrium may be pushed too far to the alkali side and alkalosis occur unless care is taken. We may have either a condition of acidosis compensated or

acidosis decompensated, or the opposite may occur of a compensated or decompensated alkalosis. Furthermore, Means has pointed out that in certain conditions, such as pneumonia, the buffer of the blood may be normal, but the reaction more acid than normal due to carbonic acidosis. In such a case the condition is probably due to the fact that the pulmonary ventilation is insufficient to preserve the normal ratio between the soluble carbon dioxide and the bicarbonates and the blood is not getting enough carbon dioxide out. It is important, therefore, not only to estimate the reaction of the blood, but also to estimate the available alkali, and it is the estimation of these factors that establishes whether there is a compensated or decompensated acid base equilibrium.

The acidosis found associated with severe diarrhea in infancy is not due to the presence of acetone bodies, but rather to the deficient excretion of acid phosphates by the kidneys. In such cases administration of soda bi-carbonate will often correct the characteristic symptoms and give normal blood tests for alkali reserve. Notwithstanding this the child may die. Undoubtedly, in such cases the metabolism of the cells themselves has been disturbed, and simply correcting the blood alkalinity is not sufficient to restore the cellular equilibrium. The importance of these blood studies is, that by repeated blood tests we are able to arrive at a more accurate knowledge of the internal metabolism early enough to correct it, whereas if we wait until definite symptoms appear, even the most approved treatment will not check the process sufficiently to save the patient.

In nephritis the study of the non-protein nitrogen in the blood becomes important and gives a better indication of kidney function than almost any other of our functional tests both from the prognostic and therapeutic standpoint. This is perhaps more correct for chronic nephritis than for acute nephritis.

In acute conditions elimination of salts is, as we have learned, probably more important. The retention of chlorides resulting from conditions of lowered permeability of the kidneys and the retention of phosphates in the blood have a great deal to do with the production of acidosis. Where the phosphates are greatly increased, the calcium content is greatly decreased and acidosis may result. In parenchymatous nephritis the retention of salts is greater than that of the non-protein nitrogen elements. The non-protein nitrogen composition of the blood, although it constitutes only one per cent of the total nitrogen of the blood, is more important because the non-protein nitrogen factors show both the anabolic and catabolic processes more than the protein nitrogen or, at least, they give us a better insight into what is going on, and variations from the normal in the non-protein elements often aid us in appreciating what is really happening.

It has been shown by many studies that the various constituents of non-protein nitrogen have different origins. Urea is largely exogenous, while uric acid is partly endogenous and partly exogenous under normal conditions of diet and health, and creatinin is almost entirely endogenous. Urea is produced mainly by the liver as a result of the de-aminization produced during digestion, which is not used immediately by the blood. Uric acid, on the other hand, is the result of enzymatic transformation of the amino- and oxy-purin. Creatinin is supposed to be formed in the muscles from creatin.

The distribution of these non-protein nitrogen constituents differs greatly in the blood and urine. The percentage of uric acid in normal blood is greater than in urine, while the urea is much lower. In the case of creatinin and ammonia it is very much lower. The kidneys remove creatinin and ammonia with great ease, whereas it is not so easy to remove uric acid. This explains why in any altered function of the kidneys the blood first shows a retention of uric acid, then urea, and lastly creatinin.

In diseased conditions of the kidneys the normal level of urea and non-protein nitrogen in the blood is usually first affected. The relationship between urea in the blood and the output in the urine should always be carried on together, especially in the study of kidney function. The important thing is the ratio between the urea content of the urine and the blood. One may have a high blood urea level with a high urinary output and still have a fairly good functioning kidney. Whereas, if the blood urea is high while the urinary output is low it shows a very much more marked defect in kidney function. Addis has devised a urea function test that aims at an estimation of the functional capacity of the kidneys when put under strain by feeding urea. This, after all, is the most important evidence needed both from the standpoint of prognosis and treatment. Urea retention occurs under a great many different conditions besides nephritis as in cardiac conditions, in syphilis, in lead poisoning, and in many of the anemias.

The blood volume, as well as the concentration of the blood, plays an important role in the pathological physiology of the blood. In pathological conditions the changes from the normal blood volume are quite striking. For example, the blood volume following severe diarrhea is markedly decreased, and in these cases the hematocrit readings show a very marked relative increase in the red blood cells and a diminution in the plasma volume. In chronic intestinal and nutritional conditions such as athrepsia or malnutrition, the blood volume in these cases is relatively increased, whereas the red cell volume is decreased. It is, therefore, important in interpreting the number of red cells to consider the change in blood volume and water content of the body. The water content of the body in children is especially affected by two factors, age and feeding. We have shown a definite curve in the blood volume in new-born infants and in infants during the first year of life.

The effect of food on the water content and, therefore, the concentration of the blood has been shown to have a definite relationship to the amount

of carbohydrate food given. With high carbohydrate food there is definite retention of water in the tissues. It has been shown that glycogen, when it is stored in the body, takes with it three times its weight in water, so that children on a high carbohydrate diet would tend to have a diminished blood volume. In nutritional conditions with marked anemia, the rate of circulation in the venous and capillary blood is important. It has been shown that there is a marked increase in the red cells and hemoglobin content in the capillaries in cases of marked malnutrition, and that this is due to the peripheral constriction of the blood vessels, which is not found in normal infants nor in those suffering from other conditions except in acute diarrhea. In both diarrhea and athrepsia or malnutrition the blood flow is markedly decreased. In anemias, even where the total blood volume is not markedly lowered, there is a change in the comparative percentage of plasma and cells, as there is a relative increase in the plasma and a diminution in the red blood cell percentage. In both chronic nutritional conditions and anemias the plasma volume may be as high as 80 per cent of the total hematocrit readings. Boch has pointed out, however, that plasma tends to be constant, so that the variation in these pathological conditions is one mainly of the red blood cells.

Where the reduction of the blood volume is as low as 20 per cent, as has been shown by Robertson and Boch, there is definite indication for transfusion because a lower limit is incompatible with life. These studies in blood volume have shown the importance of transfusion when the blood volume is so markedly reduced. In cases of acute diarrhea, vomiting, starvation, athrepsia or malnutrition, as soon as food or fluid is given, the blood volume will be rapidly restored as well as the blood flow increased. The importance of the water quotient has thus been definitely determined by a careful study of these blood factors, and these studies have undoubtedly had more effect on lowering the mortality of these nutritional conditions in infants than any other studies that have been carried on during the last few years.

In this rather cursory discussion of some of the modern lines of investigation of the blood I have simply tried to indicate the various lines along which these problems can be attacked, and have pointed out some of the achievements which have resulted from these studies. We can confidently expect that our knowledge of these problems will be much clarified by the continuation of these investigations.

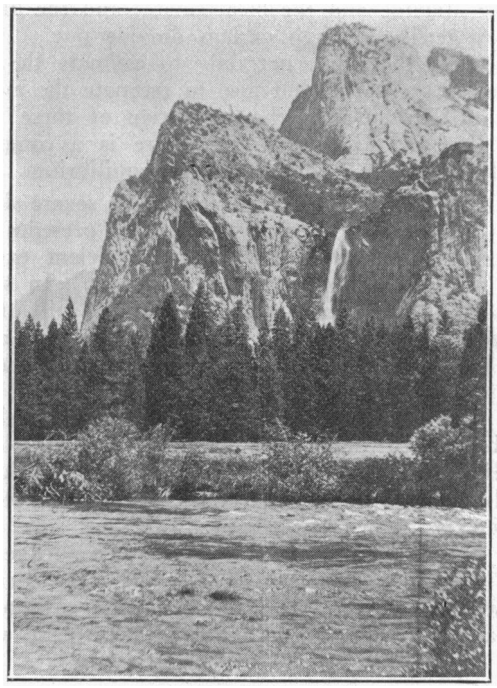
The Yosemite Meeting

SUGGESTIONS FROM THE PUBLICITY COMMITTEE

How do we get there and where do we stay after we arrive?

Those are the two big questions in connection with any convention, not excepting those held in such a well-known place as Yosemite. Both will be answered here as briefly and as comprehensively as possible for the benefit of those who will attend the annual meeting of the Medical Society of the State of California, May 15-18, 1922.

Yosemite National Park—most popular of all the Nation's parks—lies almost due east of San Francisco in the heart of the Sierra Nevada Mountains and is reached by railroad and by several good automobile roads. Main lines of both Southern Pacific and Santa Fe, in the San Joaquin Valley between San Francisco and Los Angeles, pass through Merced, from where the Yosemite Valley Railroad leads up the beautiful canyon of the Merced River to El Portal, at the Park



THREE GRACES AND BRIDALVEIL FALLS AS SEEN FROM BANK OF MERCED RIVER IN YOSEMITE VALLEY EN ROUTE EL PORTAL TO YOSEMITE.

boundary. A Government highway that is like a boulevard extends from El Portal fifteen miles farther up the canyon to Yosemite Valley, the heart of the park. The drive from El Portal to Yosemite, as the village is known, is a matter of an hour, in the comfortable motor cars of the Yosemite Transportation system, one of the most spectacular hours in a lifetime, for the broad road leads through a panorama of cliffs and forests and waterfalls that has no superior anywhere in the world.

On this ride, the visitor passes through the famous "Gates of Yosemite," where El Capitan towers 3604 feet on the left, with Three Graces making a perfect background for Bridal Veil Falls on the right and Clouds' Rest and Half Dome loom up in the middle distance.

The rail journey from Merced to El Portal is only 78 miles, a trip of about four hours through famous placer mining country still scarred by the activities of '49. Detailed schedules and fares from all principal points in the State will be furnished later.

The Wawona road, 90 miles from Merced to Yosemite, paved or macadamized for 38 miles of that distance, probably will be the best road for the use of those who will go to the convention in their own machine, as the Big Oak Flat road sometimes does not open until later because of snow on the higher altitudes. However, road conditions depend on the season, and the weekly bulletin of the Superintendent of Yosemite National Park, distributed to all agencies of the California State Automobile Association and the